

Providing medical attention to the wounded according to the TCCC standard

(Udzielanie pomocy rannemu według standardu TCCC)

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Abstract – In this article, the focus is on the principles of care provision within the TCCC standards. The detailed accounts of the Care Under Fire, Tactical Field Care, and Tactical Evacuation Care (MEDEVAC/CASEVAC) phases are presented. The differences of rescue actions in tactical combat and away from battlefield are emphasised

Key words - medical care phases, TCCC standards.

Streszczenie – W artykule tym skupiono się na zasadach udzielania pomocy wg standardów TCCC. Omówiono szczegółowiej postępowanie w fazie Care Under Fire, Tactical Field Care, Tactical Evacuation Care (MEDEVAC/ CASEVAC). Podkreślono różnice występujące w zachowaniu ratowników podczas działań taktycznych a działań ratowniczych poza polem walki.

Słowa kluczowe - fazy pomocy poszkodowanemu, standardy TCCC.

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- A. The idea and the planning of the study
- B. Gathering and listing data
- C. The data analysis and interpretation
- D. Writing the article
- E. Critical review of the article
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I. AIM OF THE STUDY

The aim of the study was to present the assumptions between medical care over the wounded in tactical combat environment.

II. DATA SOURCES

The data source search has been conducted in the Scopus database using the key phrase of *Tactical Combat Casualty Care* in the records for the period from 2004 to 2014. Thus selected references were narrowed down using Google Scholar to include only those with the largest numbers of citations on the subject matter. They were the material for this study.

III. THE CARE UNDER FIRE PHASE

The Care Under Fire (CUF) phase is based on the principle of good tactics being the best medical care. The main priority is to gain advantage in the exchange of fire or eliminate the enemy, which allows the unit to avoid further casualties, provide care to the wounded, and proceed with evacuation (Table 1). During training, each soldier should master the skill of self-aid in the Care Under Fire phase. If the soldier's condition permits, he should seek cover and wear a tourniquet if there is an extremity haemorrhage. The

priority at this stage is to stop any haemorrhages that are a lethal threat. The material provision consists in equipping the wounded and other team members individually. According to TCCC procedures, the least seriously wounded should be aided first so that they can come back to their tasks and support the team. On a battlefield, the more soldiers are fighting, the greater the probability of survival. The only hope of the wounded are those alive.

Table 1. The basic action plan in CUF zone one – under fire [2]

1. Do not cease fire. Seek cover.
2. Guide the wounded and expect them to take part in combat as long as it is right.
3. Instruct the wounded to keep taking cover and apply self-aid if possible.
4. Make an effort to keep the wounded from further harm.
5. Evacuate the wounded from burning vehicles or buildings and take them to relative safety. Neutralize burns if possible.
6. Unblocking of airways should be postponed until the next phase (TFC).
7. Stop the life-threatening external haemorrhages if tactically possible: <ul style="list-style-type: none"> • Haemorrhage self-aid, if the wounded are able to do that. • Use the TCCC-recommended tourniquet for haemorrhages. It is anatomically amenable to tourniquet application. • Apply the tourniquet proximal to the bleeding site, over the uniform, tighten, and move the casualty to cover.

In the CUF phase, there is a possibility to remotely examine the wounded. This test should be applied in so-called CQB (Close Quarters Battle) – a situation when there is no possibility of approaching the wounded. If there is verbal contact within the AVPU/V scale with the casualty, the rescuer should instruct the casualty loudly to seek cover in a safe zone or help with self-diagnosis and self-aid [4]. The purpose of the examination is the observation of the following parameters: consciousness state, respiration, and skin. A sniper can also use the rifle scope to observe a casualty to identify the injury and the casualty's life functions better. Thanks to this, a team leader can prepare the team to evacuate the casualty [6] (Figure 1).

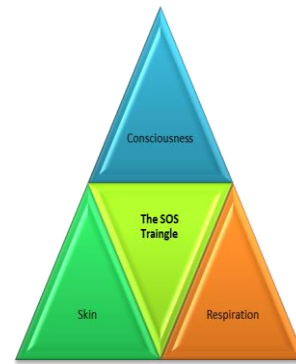


Figure 1. The assessment of casualties by observation of the three parameters [7]

The assessment of the casualty's consciousness consists in detecting the body movement and body position, which can help evaluate on the type of wounds inflicted. Determining the mechanism of the injury (explosion, penetrating chest wound) and the exposition of the body during examination allows one to "predict" the range of injury.

The breath of the casualty should be assessed by observing the movement of the chest in tactical vest. Counting the number of breaths over long distance can be difficult because of the tactical situation. If the breaths-per-minute ratio is over 30 or under 10, the neck veins are widened, and the mechanism of the injury suggest traumas to the chest, tension pneumothorax or other chest wounds should be expected.

The final element of the SOS triangle is the skin. If the casualty is located within a direct distance from the enemy weapon, one should look for blood on the casualty's uniform and instruct him to put on a tourniquet. The aforementioned procedures are a proposal of the SOS triangle put to use even in cases of paediatric patients [8].

IV. THE BASIC PROCEDURES IN TACTICAL FIELD CARE PHASE

The second phase, Tactical Field Care (TFC), consists in providing medical care in the field and performing rescue activities in a zone of relative safety (after a firepower advantage is gained). It has to be remembered that a relatively safe zone can turn back into a CUF zone any minute. Therefore, a significant element in tactical combat is securing the location against possible continuation of enemy fire. The criteria of difficulty in the Tactical Field Care phase are presented in Figure 3.

Procedures performed in Tactical Field Care are related to the traumatic examination of the casualty and treating the wounds [8].

Traumatic examination of casualties in tactical combat environment is performed according to Tactical Patient Assessment (TPA) protocol – the basic trauma examination and a MARCHE algorithm. The aim of both protocols is to identify the locations of bleeding and other wounds that might be a factor during combat.

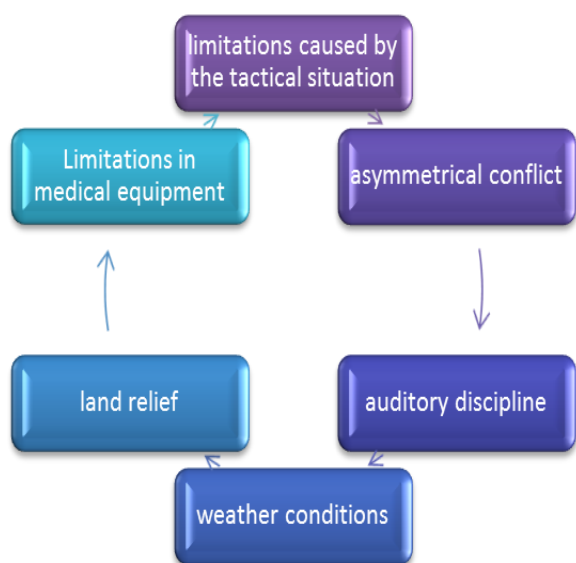


Figure 2. Difficulty criteria in Tactical Field Care [2]

In order for a medic to approach a casualty, a number of conditions must be fulfilled. The first one is firepower advantage which can momentarily provide superficial level of safety to the medic and the casualty. A significant element is to provide enough firepower and resources via the support of teammates and employing vehicles to proceed with the planned evacuation. The determination of the trauma mechanism might have implications about the potential outcomes of the injury. Before obtaining the commanding officer's permission to approach the casualty a contact attempt must be made. Each examination is preceded with disarming the casualty (firearms, grenades, knives, radios etc.).

In a TPA examination, the indication to implement this protocol is the environment with no light when night-vision devices are used. The necessity to maintain light discipline

is related to the need for the medic or field team to remain concealed. The examination is conducted through the casualty's uniform and its objective is to detect massive extremity haemorrhages. The rescuer forms a "rake" by bending his or her fingers into a hook shape and examines first the legs of a victim (groins, the front, the sides, and the back) and then the arms (armpits, medial parts of arms and forearms, the front, the sides, and the back). In case there is bleeding, a rescuer should put a tourniquet on the limb as high as it is possible. The next element is the assessment of breath – the airways need to be patent. During the whole procedure, the casualty should be lying in order to minimize the risk by letting the rescuer keep a lower body position [7].

The MARCHE test should be carried out after the external danger is eliminated. In such circumstances, the combat situation allows the rescuer to perform a detailed examination in the light and using medical equipment. The MARCHE protocol is based on the assessment of the following elements that form a mnemotechnical acronym to help remember the sequence: [9]:

- **Massive haemorrhage control** – looking for sources of external bleeding, starting from legs and proceeding on to arms.
- **Airway management** – diagnosing airway obstructions and securing airway patency.
- **Respiratory management** – the assessment of breath quality, diagnosing and treating tension pneumothorax.
- **Circulation (BIFT)** – the assessment of cardiovascular system:
 - **Bleeding control** (repeated attempt to control haemorrhages, including internal ones; a novelty in TCC procedures is applying tranexamic acid in pre-hospital care).
 - **Intravenous/intraosseous access** (ensuring there is access to veins and marrow).
 - **Fluid resuscitation** – implementing fluid resuscitation with little amounts; peripheral pulse control.
 - **Tourniquet assessment and removal** – attempting to replace a tourniquet with a haemostatic means or blocking the wound with rolled gauze..
- **Hypothermia** – using Hypothermia Prevention Kit or Helios systems to prevent from hypothermia.
- **Head injury** – diagnosing head injuries, including especially traumatic brain injuries (TBI).
- **Eye injury** – diagnosing eye injuries.

- Everything else (M-PHAAT-D, additional procedures)
 - **Monitoring** – the monitoring of vital functions depending on the means available.
 - **Pain** – analgesics – soothing the pain.
 - **Head to toe** – a detailed examination from head to toes, including undressing the casualty.
 - **Address all wounds** – securing the wounds that are not life-threatening.
 - **Antibiotics** – applying antibiotics with a wide spectrum of effects.
 - **Tactical evacuation preparation** – preparing from transportation.
 - **Documentation of care** – documenting the medical activities undertaken (for a higher level healthcare), most often in the form of a TCCC Casualty Card or permanent marker writing on the casualty's body.

After the MARCHE protocol is implemented, the implementation of medical procedures should be verified. This goes for RPA (Rapid Trauma Assessment), the check-up of the casualty's condition using the AVPU scale, and the CBA (Airway, Breathing, Circulation) assessment.

V. THE BASIC PROCEDURES IN THE TACTICAL EVACUATION CARE PHASE

The third phase – Tactical Evaluation Care – is based on the international ALS (Advanced Life Support) procedures and on PHTLS (Pre-hospital Trauma Life Support). A rescuer who provides medical attention in the safe zone has to:

- assess the location of the incident,
- assess the type of the incident – single, multiple, or mass with the implementation of a casualty-segregation procedure (TRIAG) in order to help as many casualties as possible,
- start medical procedures in the cases of the most severely wounded.

The assessment of the casualty consists of 2 stages – introductory (primary) and final (detailed). It takes into account the procedures implemented earlier and the medical equipment used mainly to stop massive bleeding, treating

the pneumothorax, securing other chest wounds, and ensuring airway patency [10].

The actions listed below are performed as a part of assessing a casualty's condition [11-12]:

1. A – Airway management and cervical spine stabilization,
2. B – Breathing (ventilation),
3. C – Circulation and bleeding,
4. D – Disability,
5. E – Expose/environment.

At the beginning of a trauma examination a rescuer should secure the airway patency (also using endotracheal intubation, if the situation and the rescuer's skills allow) or maintain and control the patency established before, paying special attention to stabilising the neck using a neck collar. After the airway is made patent, the breathing ability of a casualty should be assessed based on the number of breaths counted within 10 seconds and multiplied by six to obtain a per-minute ratio. Also, the chest movements should be observed for paradoxical and asymmetrical activity. If possible, an SpO2 saturation test should be performed and the check should be examined to confirm or rule out tension pneumothorax or hemothorax. If tension pneumothorax or other breathing disorders are present, a needle decompression of the chest should be performed. The needle should be entered into second intercostal space in linea axillaris anterior or, alternatively, into the fifth intercostal space in linea axillaris anterior. If the pneumothorax was relieved before, the casualty's condition and decompression effectiveness should be assessed. Sometimes using only one needle is insufficient to relieve the pneumothorax effectively. If it is the case, other injections should be performed right next to the location of the first needle.

In case of respiratory diseases, ventilation using a bag valve mask should be carried out. Open wounds of the chest should be secured with an occlusive dressing. If the saturation level falls below 94%, active or passive oxygen therapy should be undertaken depending on the casualty's condition.

Another step in the assessment of the injured is the control of circulation and bleeding. The first step is to verify whether all external haemorrhages were stopped. In case there is a need to perform a quick trauma assessment, the presence of the pulse is verified on the carotid and radial arteries. No pulse in the circuit means the circulation is centralised, which may cause a shock. In order to assess the blood circulation, the following tests are needed: blood pressure test, a three-lead electrocardiography, the examination of jugular vein filling, and examining heart sounds to identify cardiac tamponade. Taking blood pressure and ECG is usually impossible in tactical combat. After vein or

marrow access is obtained, a fluid resuscitation should be considered, even during the preparation for evacuation or during the evacuation itself.

In order to assess the consciousness of a casualty, the AVPU and/or GCS scales are used. Additionally, the pupils are assessed using the PEARRL measure (pupils, equal and round, reactive to light). In case the reason for unconsciousness is not known, blood sugar should be tested.

The last stage of the assessment is a detailed post-traumatic „head to toe” examination. Its aim is to locate any visible injuries. When taking off a casualty’s equipment, one has to remember about maintaining the proper body warmth and covering the person in order to protect him or her from hypothermia. A crucial element of this examination is stabilising any loose (broken) limbs and preparing the casualty for transportation. If the activities performed were to delay evacuation, they should be waived.

Medical evacuation in tactical environment is a string of changing circumstances and events which often represent obstacles and difficulties for rescuers (light and sound discipline, the weight of the casualty combined with rescuer’s equipment, controlling the casualty’s inert body). Evacuation of the injured out of the danger zone is a complex operation with a different difficulty level, as the available forces and landscape need to be taken into account. The success of evacuation is dependent predominantly on tactical situation in each phase (CUF, TFC, TEC). Regardless of the situation, the operations should be carried out dynamically and with consideration to the safety of casualties and rescuers and the condition of the wounded.

It has to be emphasised that the evacuation of the wounded is realised using different techniques and methods depending on the zone. In a CUF zone, the main techniques are the so called buddy carries. This is caused by the condition of the injured and non-existent possibility of self-evacuation or seeking cover. The choice of a rescue technique is dependent on the tactical situation as well as physical ability of the rescuer, the body weight of the casualty and the landscape (distance, ground type). The most common CUF zone evacuation methods include: fireman’s carry, „tortoise”, and Rautek grip. An alternative for buddy carries are tapes and lunges (long lines with a piton at the end). Lines from behind a cover are used in situations when the injured are conscious and able to fasten the piton to the clips in their vests, enabling the rescuer to drag the casualty into safety. The most commonly used types of tapes for evacuation are „dragon handle”, „rat strap”, „hasty harness”, and „high treat extraction kit”.

The a TFC zone, the combat situation allows for the use of readymade evacuation platforms. The selection of

equipment is dependent on the specificity of combat force activities and the environment in which the equipment is to be used. In Tactical Field Care, “phantom” stretchers, personal tactical stretchers, rolled “foxtrot” stretchers, and spinal boards (rarely on the battlefield) are used.

Rescue actions in Tactical Evacuation Care are implemented in order to evacuate the wounded safely from the danger zone and transport them using MEDEVAC/CASEVAC (medical vs. combat) means, also wheeled armoured vehicles. Medical procedures implemented in the aforementioned means of transport are based on Advanced Life Support (ALS) and Advanced Trauma Life Support (ATLS) standards [13].

Medical interventions during evacuations are organised as the current battlefield situation allows. Evacuation of the wounded during the Enduring Freedom/ISAF (International Security Assistance Force) operation in Afghanistan is mainly airborne, using Black Hawk helicopters. It is a consequence of the intensity of land kinetic operations, large distances between operation sites, and the peculiar landscape [14]. The use of a helicopter limits the time of casualty transportation to a secondary referral hospital to 20 minutes, which increases the casualty’s survival chances. The commencement of MEDEVAC/CASEVAC procedures is preceded with a 9-line MEDEVAC report submitted to the tactical operation centre. Such a report uses a letter code to convey coordinates (numbers that specify the location in the landscape or space in relation to a coordinate system set) of the commencement spot, the information on the number and condition of the wounded, their nationality, equipment, enemy activity and the landing zone indicators. This report is complemented by a MIST report that classifies the condition of the wounded based on the mechanism of the injury, wounds inflicted, vital functions according to ABCDE scheme and rescue actions taken so far.

While waiting for the MEDEVAC/CASEVAC means of evacuation to arrive, the wounded should be assessed using the MARCHE protocol dedicated for the Tactical Field Care phase. Assessed are the functions that are the most urgent to be addressed: haemorrhages, airway patency, chest traumas, circulation, preventing hypothermia, diagnosing craniocerebral injuries, and examining eyeballs. The maintenance of a proper body temperature is a significant factor for blood clotting. According to the TCCC standard, in order to prevent hypothermia from occurring, readymade „Hypothermia prevention and management kits” (HPMK) should be used. These kits are composed of: a thick sleeping bag, a heating blanket (sustaining a 53°C temperature for 8 hours), a protective material for the head, and ear-protective plugs for a more comfortable flight. During

evacuation, a casualty should be equipped with a ballistic vest and protective goggles [15].

During MEDEVAC/CASEVAC with medical personnel on-board, the post-trauma examination should be repeated. The casualty is treated as a new patient in the diagnostic process, which entails controlling the basic vital functions. MEDEVAC/CASEVAC transportation allows medical staff to monitor the condition of the wounded in an advanced manner. To assess intubated patients, a capnograph is used, since sounding the casualty is not possible in transport. An important element in the diagnosis and prognosis of hypovolemic shock is the monitoring of the heart rate (ECG), especially in the cases of the unconscious. It is the authors' opinion that a casualty with a cardiac arrest in pulseless electrical activity (PEA) or asystole should be resuscitated. Despite the fact that cardiopulmonary resuscitation is not recommended in the TCCC standard, in cases when the distance to a surgical hospital or a Trauma Room is not large the application of CPR improves the casualty's chances for survival, especially if the cardiac arrest is in the PEA mechanism [17].

VI. REFERENCES

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